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(54) LIGHT-REFLECTING FILM AND OPTICAL RECORDING MEDIUM USING THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To improve recording properties and durability by using a light-reflecting film which contains each one or more kinds of elements selected from a first group consisting of Al and Ag and a second group consisting of Bi, Rh and Zn and has specified thermal conductivity and reflectance of specified range for light of a specified wavelength.
SOLUTION: The combination of metal elements is made to Al and Bi and/or Rh or Ag ans Bi and/or Zn and the total number of metal atoms in a second group is made to 1 to 49% for the total number of atoms of the first and second metals. The thermal conductivity is made to 140 to 370 W/(m.K) and the reflectance is made to ≥70% for light in 830 to 370 nm wavelength range. When a reflecting film having the thermal conductivity above described is applied for a DRAW type optical recording medium using a dye as a recording layer, good pits can be obtd. while maintaining the recording sensitivity and further, good adhesion between the recording layer and a reflecting layer can be obtd.

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CLAIMS

[Claim(s)]

[Claim 1] Light reflex film characterized by a reflection factor being 70% or more to the wavelength light which it comes to contain one or more sorts each of elements chosen from the 1st group who consists of aluminum and Ag, and the 2nd group who consists of Bi, Rh, and Zn, and thermal conductivity is 140-370W/(m-K), and is 830-370nm.

[Claim 2] Light reflex film according to claim 1 which uses the 1st group's metal as a principal component, and is characterized by containing it 1 to 49% to the atomic number of all the 1st and 2nd groups' metals, using the 2nd group's metal as an atomic number.

[Claim 3] Light reflex film according to claim 1 or 2 characterized by containing aluminum, Bi and/or Rh or Ag and Bi, and/or Zn.

[Claim 4] The optical recording medium characterized by the record layer containing coloring matter, and having the reflective film according to claim 1 to 3 at least on a transparent substrate.

[Claim 5] The optical recording medium according to claim 4 characterized by the reflection factor to the laser beam chosen from 450-370nm which carried out incidence from the substrate side being 15% or more.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the light reflex film for postscript mold optical recording media corresponding to blue laser wavelength from the light reflex film, especially near-infrared laser.

[0002]

[Description of the Prior Art] In order to reproduce recording information as an optical recording medium conventionally The optical recording medium only for readouts which formed the light reflex layer which consists of metal membranes, such as Au and aluminum, in the field which formed a pre pit and PURIGURUBU on substrates, such as a product made from a translucency polycarbonate, using the means of a press etc. beforehand, and formed this pit, and formed further the protective layer which consists of photo-curing mold resin on it is put in practical use as a compact disk (it omits Following CD). This CD has spread widely in order to carry out preservation playback of music, an image, data, the program, etc. The specification about record and the regenerative signal of this CD is specified as CD specification, and the regenerative apparatus based on this specification has spread widely as a CD player.

[0003] as a postscript mold optical recording medium corresponding to CD specification, CD-Recordable (it abbreviates to CD-R below) is proposed and developed -- [-- for example, Nikkei electronics [ ] -- No.465 and p. --], such as 107, a 1989 year 1 month 23 day number, OPTICAL DATA STORAGE DIGEST SERIES vol.1, p.45, 1989, JP,2-132656,A, JP,2-168446,A, and JP,3-215466,A. The laminating of a record layer, a reflecting layer, and the protective layer is carried out in this order on the transparence resin substrate, and this CD-R records information for a change physical [a record layer] or chemical in the form of a lifting and a pit by irradiating a high-power laser beam at this record layer. The laser beam of low power is irradiated to the formed pit part, and the information on a pit can be reproduced by detecting change of a reflection factor. Commercial CD-R has a record layer containing coloring matter, roughly divides it as this coloring matter, and has phthalocyanine dye and cyanine dye. This reflecting layer is stuck and prepared in the pigment layer, in order to usually obtain the reflection factor based on CD specification, the reflection factor of a reflecting layer is high, and moreover, Au thin film with good corrosion resistance is used [for example, JP,2-79235,A].
[0004] Since these CD-R media perform record and playback using 830-770nm near-infrared semiconductor laser and are based on the specification of CDs, such as Red Book and an Orange Book, they have the description of having a CD player, a CD-ROM player, and compatibility. Recently, red semiconductor laser with a wavelength of 690nm - 620nm was developed, and it became record of high density, and/or reproducible. For example, the high density record medium which has one 5 to 8 times [over the past] the storage capacity of this, and this player corresponding to a high density record medium were developed. Moreover, laser of the wavelength 530nm by higher-harmonic conversion of an YAG laser and near 420nm is put in practical use, and development of the semiconductor laser of the wavelength 490nm, 410nm, and near 370nm is also performed further.
[0005] Then, the optical recording medium which can be written in is proposed once by the high density using the coloring matter corresponding to such short wavelength laser, and it is necessary in such an optical recording medium to use the reflective film which has a high reflection factor in a short wavelength field. Furthermore, it is necessary to control the thermal conductivity of this reflective film and to optimize the sensibility to decomposition of a record layer, and a laser beam etc. Although alloys, such as Ag-In, Ag-V, or Ag-Nb, were used for the reflective film and thermal conductivity is specified on it by JP,6-243509,A, it is not a thing in consideration of decomposition of a coloring matter record layer. Moreover, when reflective film, such as Au, aluminum, Ag, etc. which are used from the former, was used for the postscript mold optical recording medium which contained coloring matter in the record layer and record playback was carried out using short wavelength laser, problems, such as heat control and adhesion, arose and the reflection factor especially fell extremely on blue laser wavelength by Au.
[0006]
[Problem(s) to be Solved by the Invention] The purpose of this invention is being a high reflection factor and offering the light reflex film which adhesion with a pigment layer is good and has moderate thermal conductivity in record to the light from near-infrared [which can be used for the optical recording medium which carried out densification by short wavelength-ization of a laser light source, especially the postscript mold high density optical recording medium which contains coloring matter in a record layer] to blue wavelength.
[0007]
[Means for Solving the Problem] this invention persons came to complete this invention, as a

result of repeating examination wholeheartedly that the above-mentioned technical problem should be solved. That is, this invention relates to the optical recording medium given [aforementioned] in ** characterized by the reflection factor to an optical recording medium and the laser beam chosen from 450-370nm which carried out incidence from ** substrate side characterized by providing the following being 15% or more. ** It comes to contain one or more sorts each of elements chosen from the 1st group who consists of aluminum and Ag, and the 2nd group who consists of Bi, Rh, and Zn. The light reflex film characterized by a reflection factor being 70% or more to the wavelength light which thermal conductivity is 140-370W/(m-K), and is 830-370nm, ** Use the 1st group's metal as a principal component, and receive the atomic number of all the 1st and 2nd groups' metals. As the light reflex film given [aforementioned] in ** characterized by containing it 1 to 49%, using the 2nd group's metal as an atomic number, and **aluminum, Bi and/or Rh, or the aforementioned ** characterized by containing Ag, Bi, and/or Zn or the light reflex film given in **, and ** -- the record layer which contains coloring matter at least on a transparent substrate Reflective film given in either the aforementioned ** - **
[0008]
[Embodiment of the Invention] The reflective film of this invention which combined the specific element at a certain rate has 70% or more of high reflection factor to the light of a near-infrared - blue wavelength field, and moreover has thermal conductivity moderate when adapted for an optical recording medium, and its adhesion with a pigment layer is good. The rate of these elements that the reflective film of this invention comes to contain one or more sorts each of elements chosen from the 1st group who consists of aluminum and Ag, and the 2nd group who consists of Bi, Rh, and Zn, and are occupied to a reflecting layer is 50% of the weight or more of a thing. Especially the reflective film of this invention enables good record and playback in a blue wavelength field in the optical recording medium of the postscript mold which used coloring matter for the record layer from green.
[0009] The laser beam as used in the field of this invention is the laser of the wavelength the blue semiconductor laser of the wavelength the green laser of the oscillation wavelength the near-infrared semiconductor laser of the oscillation wavelength near 830 or 780nm, 680 and 650 and the red semiconductor laser of the oscillation wavelength near 635nm, 530nm, and near 490nm, 410nm, and near 370nm, 530nm by higher-harmonic conversion of an YAG laser, and near 420nm further. The optical recording medium of this invention is refreshable in one wave or two or more wavelength which are chosen from these, and a reflection factor is 15% or more.
[0010] The concrete configuration of this invention is explained below at a detail. The reflective film of this invention contains one or more sorts each of elements chosen from the 1st group who consists of aluminum and Ag, and the 2nd group who consists of Bi, Rh, and Zn. The thermal conductivity of this reflective film is 140 - 370W/(m-K), and a reflection factor is 70% or more in 830-370nm wavelength light. In addition, it takes into consideration and it is determined that it is desirable that the sum total of the content atomic number the 2nd group's metal is 1 - 49% to the sum total atomic number of all the metals of the 1st and the 2nd group, and the value of this mixed rate of thermal conductivity suits to a predetermined value. It is the reflective film which comes to contain aluminum, Bi and/or Rh or Ag and Bi, and/or Zn preferably especially.
[0011] The thermal conductivity of the reflective film of this invention is 140 - 370W/(m-K). When for the optical recording medium which used coloring matter as the record layer, and heat is [such reflective film] bank-easy in a record layer and thermal conductivity records it on it by the reflective film of 140W / (m-K) following, a beautiful pit is hard to be obtained for the effect of the heat around a record pit. On the other hand, by the larger reflective film than 370W/(m-K),

there is an inclination for record sensibility to fall that the heat of a record layer tends to escape. Furthermore, if it is the reflective film of this invention, the adhesion between a record layer and a reflecting layer will make it good, and the endurance of a medium will improve.

[0012] Moreover, although the reflective film of this invention mainly contains the metal of the aforementioned 1st and the 2nd aforementioned group, other metals may be contained and Cu, V, Ta, Cr, Mo, W, Mn, Fe, Co, nickel, Pd, Pt, Au, etc. are mentioned as other metals. In the reflective film of this invention, the total content (sum total of a content atomic number) of one or more metals chosen from a metal besides these is 20% or less to all the atomic numbers of aluminum and/or Ag. As the formation approach of the reflective film of this invention, a spatter, the ion plating method, chemical vapor deposition, a vacuum deposition method, etc. are mentioned, and membranes are usually formed to the thickness which is 500-2000A, for example. The spatter which used the plural metal target or the alloy target especially is desirable.

[0013] Next, it describes about the optical recording medium using the reflective film of this invention as a reflecting layer. The optical recording medium as used in the field of this invention shows both the medium for photoregeneration only for playbacks which is having information recorded beforehand, and the optical recording medium which can record information and can be reproduced. Here, the optical recording medium which formed the record layer, the reflecting layer, and the protective layer in this order on the optical recording medium whose playback records the information on latter and is possible as a good example, especially the substrate, and the optical recording medium which stuck the substrate on the reflecting layer side are explained. In addition, another layer may intervene between a reflecting layer and a substrate etc. between a reflecting layer and a protective layer between a record layer and a reflecting layer between a substrate and a record layer.

[0014] As the quality of the material of a substrate, fundamentally, if transparent on the wavelength of record light and playback light, it is good. For example, polymeric materials, such as acrylic resin, such as polycarbonate resin, vinyl chloride resin, and a polymethyl methacrylate, polystyrene resin, and an epoxy resin, and inorganic materials, such as glass, are used. These substrate ingredients are fabricated by the substrate disc-like by an injection-molding method etc. In the case of a postscript mold optical recording medium, a slot may be formed in a substrate front face if needed.

[0015] As a record layer, it has moderate absorption in a laser wavelength region, and it is a layer containing matter which is the exposure with the energy more than fixed of a laser beam, and is accompanied by physical/chemical deformation, deterioration, and decomposition, and this invention mainly contains coloring matter. for example, as an ingredient which has effective record ability in case record playback wavelength is 450nm - 370nm lambdamax It exists near 350nm, the refractive index in 450-370nm is large, and what has a small absorbance is desirable. Specifically Spiro system coloring matter, stilbene system coloring matter, full olein system coloring matter, imidazole system coloring matter, There are perylene system coloring matter, phenazine system coloring matter, phenothiazin system coloring matter, polyene system coloring matter, quinone system coloring matter, cyanine system coloring matter, an acridine dye, AKURIJINON system coloring matter, coumarin system coloring matter, KARUBO styryl system coloring matter, porphin system coloring matter, squarylium system coloring matter, etc. Preferably, they are polyene system coloring matter, stilbene system coloring matter, and quinone system coloring matter. in addition, the coloring matter which a record layer is made to contain in this invention -- said coloring matter -- independent -- you may use -- two or more sorts of coloring matter -- mixing -- or a laminating may be carried out.

[0016] Moreover, it is also possible to introduce as a substituent the radical which shows mixing or such engine performance to coloring matter if needed for additives, such as a quencher, a coloring matter pyrolysis accelerator, an ultraviolet ray absorbent, and adhesives. As a quencher, metal complexes, such as bis-dithiol systems, such as an acetylacetonato system, a bis-dithio-alpha-diketone system, and a bis-phenyl dithiol system, a thio catechol system, a salichlaldehyde oxime system, and a thio bis-phenolate system, are desirable. Moreover, an amine system is also suitable.

[0017] As a coloring matter pyrolysis accelerator, especially if promotion of the pyrolysis of coloring matter can be checked, it will not be limited by heat loss-in-quantity analysis (TG analysis) etc., for example, metallic compounds, such as a metal system anti knocking agent, a metallocene compound, and an acetylacetonate system metal complex, are mentioned. As an example of a metal system anti knocking agent, the tetracethyl lead, other lead system compounds, As an example of Mn system compound of SHIMANTOREN [Mn (CO)3 (C five H5)] etc., and a metallocene compound There are bis(cyclopentadienyl) metal complexes including an iron bis(cyclopentadienyl) complex (ferrocene), such as Ti, V, Mn, Cr, Co, nickel, Mo, Ru, Rh, Zr, Lu, Ta, W, Os, Ir, Sc, and Y. A ferrocene, RUTENOSEN, male MOSEN, nickelocene, titanocene, and those derivatives have a good pyrolysis facilitatory effect especially.

[0018] As iron system metallic compounds, besides a metallocene In addition, formic-acid iron, a ferrous oxalate, Organic-acid iron compounds, such as lauryl iron oxide, naphthenic-acid iron, stearin acid iron, and butanoic acid iron, An acetylacetonato iron complex, a phenanthroline iron complex, a bis-pyridine iron complex, An ethylenediamine iron complex, an ethylenediaminetetraacetic acid iron complex, a diethylenetriamine iron complex, A diethylene-glycol wood ether iron complex, a JIHOSUFINO iron complex, Chelate iron complexes, such as a dimethyl GURIOKISHI mart iron complex, a carbonyl iron complex, iron complexes, such as a cyano iron complex and an ammine iron complex, ferrous chloride, a ferric chloride, the ferrous bromide, and bromination -- inorganic iron salt, such as halogenation iron, such as the second iron, or iron nitrate, and an iron sulfate, -- an iron oxide etc. is mentioned further. The good thing of resistance to moist heat and lightfastness meltable to an organic solvent and of the pyrolysis accelerator used here is desirable. Varieties may be mixed and used for various kinds of quenchers and coloring matter pyrolysis accelerators which were mentioned above if needed, or they may add quality of an additive, such as a binder, a leveling agent, and a defoaming agent.

[0019] As the production approach of a record layer, there are the applying methods, such as a spin coat method and the cast method, a spatter, an optical CVD method, the ion plating method, electron beam vacuum deposition, chemical vapor deposition, a vacuum deposition method, etc., and especially limitation is not carried out. However, production according to the applying method at the point which the degree of freedom and ease on coloring matter selection, a medium design, and manufacture expand more in this invention is desirable. The solvent used by the applying method dissolves or is not easy to distribute coloring matter, and must not give a damage to a substrate. for example, alcoholic system solvents (a methanol, ethanol, propanol, etc.) a halogenation alcoholic system solvent (2, 2, 3, and 3-tetrafluoro-1-propanol --) hexafluoro isopropanol etc. and a hydrocarbon system solvent (a hexane --) A cyclohexane, ethylcyclohexane, cyclooctane, dimethylcyclohexane, an octane, benzene, toluene, a xylene, etc. and a halogenated hydrocarbon system solvent (dichloromethane --) Chloroform, a hydrocarbon tetrachloride, tetrachloroethylene, dichloro difluoroethane, etc., an ether system solvent (a tetrahydrofuran, diethylether, and the dipropyl ether --) dibutyl ether, dioxane, etc. cellosolve system solvents (methyl Cellosolve, ethyl Cellosolve, etc.), and ketone system solvents (an

acetone, a cyclohexanone, methyl ethyl ketone, etc.) Ester system solvents (ethyl acetate, butyl acetate, etc.) etc. -- it is mentioned. these solvents -- one sort -- or more than one are mixed and it is used.

[0020] As an applying method, the approach of dissolving in a solvent and applying by the spin coater is desirable so that it may become about binder resin and may become 0.5 - 20 % of the weight preferably 0.05 to 30% of the weight about coloring matter 0% 20 or less % of the weight. Although the thickness of a record layer is 30-1000nm, it is usually 50-500nm preferably. In addition, although it is natural, if this thickness is not much thin, for example, is less than 30nm thickness, the heat dissipation to a metallic reflective layer cannot be avoided, but a sensibility fall may be caused. Thickness is set up so that the absorbance to the light of the playback laser wavelength of a record layer may become suitable.

[0021] Although a reflecting layer is the approach which was described above and forms membranes on a record layer, in order to raise a reflection factor and to improve adhesion, it can also prepare a reflective magnification layer and a glue line between a record layer and a reflecting layer. A protective layer can also be made to form by the still better known approach on a reflecting layer. As an ingredient of a protective layer, if a reflecting layer is protected from external force, any of organic and mineral matter will be sufficient and it will not be limited especially. As an organic substance, thermoplastics, thermosetting resin, UV hardenability resin, etc. can be mentioned, and UV hardenability resin is desirable especially. As mineral matter, SiO2, SiO, SnO2, Si3 N4, MgF2, AlN, etc. are mentioned.

[0022] When using thermoplastics, thermosetting resin, etc., it can dissolve in a suitable solvent and a protective layer can be formed by applying coating liquid on a reflecting layer and drying. After dissolving in a solvent remaining as it is or suitable and preparing coating liquid, in the case of UV hardenability resin, this coating liquid can be applied, and it can form a protective layer by irradiating UV light and stiffening it. As UV hardenability resin, acrylate resin, such as urethane acrylate, epoxy acrylate, and polyester acrylate, can be used, for example. These ingredients are independent, or may be mixed and used, and even if it uses by making it not only one layer but multilayers, it does not interfere at all.

[0023] Although the applying methods, such as a spin coat method and the cast method, a spatter, chemical vapor deposition, etc. are used like a record layer as the approach of formation of a protective layer, a spin coat method is desirable also in this. Although the thickness of a protective layer is generally in the range of 0.1-100 micrometers, in this invention, its 3-30-micrometer thickness is desirable.

[0024] Moreover, or the optical recording medium of this invention sticks a protection sheet or a substrate on a reflecting layer side, it may be the lamination of ** making both reflecting layer sides counter as the inside, and sticking two optical recording media. The optical recording medium of this invention can also perform printing of a label etc. further on a protective layer.

[0025]

[Example] Although the example of this invention is shown below, thereby, this invention is not limited at all.

[Example 1] The disc-like thing with an outer diameter [of 120mm] and a thickness of 0.6mm which has the continuous guide rail (track pitch: 0.7 micrometers) by the product made of polycarbonate resin as a substrate was used. It is 2, 2, 3, and 3-tetrafluoro in 0.25g of polyene compounds expressed with the following type (** 1) on this substrate. - 1 - The spin coat of the coloring matter solution which dissolved in propanol 10ml was carried out by rotational frequency 2000rpm, it was dried at 70 degrees C for 2 hours, and the optical recording layer with

a thickness of about 100nm was formed.
[0026]
[Formula 1]

[0027] On this record layer, the Shimadzu sputtering system was used, DC spatter of 2 yuan using aluminum target and Bi target was performed, and the aluminum-Bi reflective film with a thickness of 100nm was formed. It carried out to sputtering gas on condition that spatter power 0.5A and sputtering gas ** 1.0x10-3Torr using argon gas. The several % atom of Bi/(aluminum+Bi) was about 8% as a result of the surface analysis of the formed reflective film. To coincidence, the aluminum-Bi alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was with 73% or more, and thermal conductivity was 190W/(m-K). Furthermore, on the reflecting layer, after carrying out the spin coat of the ultraviolet-rays hardening resin, UV irradiation of said substrate and the substrate without the same guide rail was carried and carried out, the substrate was stuck, and the optical recording medium was produced.
[0028] The eight-to-fourteen modulation signal whose shortest pit is 0.4 micrometers was recorded on this medium by linear-velocity 5.6 m/s and laser power 10mW using the Pulstec Industrial optical disk evaluation equipment (DDU-1000) and the EFM encoder made from KENWOOD which carried the 430nm blue higher-harmonic-wave conversion laser head (NA=0.65). As a result of setting a laser output to 0.5mW using this evaluation equipment, reproducing a signal after record and measuring a reflection factor, an error rate, and a jitter, all showed the good value. In addition, IKORAIZESHON processing was performed at the time of playback. As a result of performing an acceleration deterioration test (it is 100 hours at 85% of humidity RH, and 80 degrees C) and measuring the reflection factor and error rate after a trial about this recorded medium, it was checked that change has the small excellent endurance.
[0029] [Example 2] DC spatter of 2 yuan using aluminum target and Rh target was performed, and the optical recording medium was produced like the example 1 except forming the aluminum-Rh reflective film with a thickness of 100nm. The several % atom of Rh/(aluminum+Rh) was about 20% as a result of the surface analysis of the formed reflective film. To coincidence, the aluminum-Rh alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was with 75% or more, and thermal conductivity was 200W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. After record, as a result of performing the same measurement as an example 1, a good recording characteristic and endurance were shown.
[0030] [Example 3] DC spatter of 3 yuan using aluminum, Rh, and Bi target was performed, and the optical recording medium was produced like the example 1 except forming the aluminum-Rh

reflective film with a thickness of 100nm. The several % atom of (Rh+Bi)/(aluminum+Rh+Bi) of the atomic ratio of Bi/Rh was about 1/7 about 40% as a result of the surface analysis of the formed reflective film. To coincidence, the aluminum-Rh-Bi alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was with 72% or more, and thermal conductivity was 160W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. After record, as a result of performing the same measurement as an example 1, a good recording characteristic and endurance were shown.

[0031] [Example 4] DC spatter using the alloy target (atomic ratio Ag:Bi=85:15) of Ag and Bi was performed, and the optical recording medium was produced like the example 1 except forming the Ag-Bi reflective film with a thickness of 100nm. The several % atom of Bi/(Ag+Bi) was about 15% as a result of the surface analysis of the formed reflective film. To coincidence, the Ag-Bi alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was with 75% or more, and thermal conductivity was 270W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. After record, as a result of performing the same measurement as an example 1, a good recording characteristic and endurance were shown.

[0032] [Example 5] DC spatter using the alloy target (atomic ratio Ag:Zn=60:40) of Ag and Zn was performed, and the optical recording medium was produced like the example 1 except forming the Ag-Zn reflective film with a thickness of 100nm. The several % atom of Zn/(Ag+Zn) was about 39% as a result of the surface analysis of the formed reflective film. To coincidence, the Ag-Zn alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was with 72% or more, and thermal conductivity was 290W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. After record, as a result of performing the same measurement as an example 1, a good recording characteristic and endurance were shown.

[0033] [Example 6] DC spatter using the alloy target (atomic ratio Ag:Zn=80:20) of Ag and Zn was performed, and the optical recording medium was produced like the example 1 except forming the Ag-Zn reflective film with a thickness of 100nm. The several % atom of Zn/(Ag+Zn) was about 19% as a result of the surface analysis of the formed reflective film. To coincidence, the Ag-Zn alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was with 75% or more, and thermal conductivity was 340W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. After record, as a result of performing the same measurement as an example 1, a good recording characteristic and endurance were shown.

[0034] [Example 7] DC spatter using the alloy target (atomic ratio Ag:Bi:Zn=65:5:30) of Ag, Bi, and Zn was performed, and the optical recording medium was produced like the example 1 except forming the Ag-Bi-Zn reflective film with a thickness of 100nm. The several % atom of (Bi+Zn)/(Ag+Bi+Zn) of the atomic ratio of Bi/Zn was about 1/6 about 34% as a result of the surface analysis of the formed reflective film. To coincidence, the Ag-Bi-Zn alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was with 72% or more, and thermal conductivity was 310W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. After record, as a result of performing the same measurement as an example 1, a good recording characteristic and endurance were shown.
[0035] [Example 1 of a comparison] In the example 1, the Shimadzu sputtering system was used on the record layer, DC spatter of the aluminum was carried out, and the optical recording medium was similarly produced except having formed the reflecting layer with a thickness of 100nm. To coincidence, aluminum alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was 80% or more, and thermal conductivity was 220W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. After record, as a result of performing the same measurement as an example 1, although the good recording characteristic was shown, endurance was bad.
[0036] [Example 2 of a comparison] In the example 1, the Shimadzu sputtering system was used on the record layer, DC spatter of Ag was carried out, and the optical recording medium was similarly produced except having formed the reflecting layer with a thickness of 100nm. To coincidence, Ag alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was 80% or more, and thermal conductivity was 408W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. after record, as a result of performing the same measurement as an example 1, bad good recording characteristic profit **** and endurance also had bad record sensibility.
[0037] In addition, the reflection factor before and behind the acceleration deterioration test carried out about the recorded medium which was obtained in examples 1-7 and the examples 1 and 2 of a comparison (after the first stage and a trial), the error rate, and the value of a jitter were collectively indicated to (Table 1).
[0038]
[Table 1]

[0039]
[Effect of the Invention] Using the suitable element, the reflective film of this invention which has the moderate thermal conductivity which limited that configuration rate had the high reflection factor in the 830-370nm wavelength field, adhesion with a pigment layer is good and a

recording characteristic and endurance became possible [offering a good optical recording medium] by using this reflective film.

TECHNICAL FIELD

[Field of the Invention] This invention relates to the light reflex film for postscript mold optical recording media corresponding to blue laser wavelength from the light reflex film, especially near-infrared laser.

PRIOR ART

[Description of the Prior Art] In order to reproduce recording information as an optical recording medium conventionally The optical recording medium only for readouts which formed the light reflex layer which consists of metal membranes, such as Au and aluminum, in the field which formed a pre pit and PURIGURUBU on substrates, such as a product made from a translucency polycarbonate, using the means of a press etc. beforehand, and formed this pit, and formed further the protective layer which consists of photo-curing mold resin on it is put in practical use as a compact disk (it omits Following CD). This CD has spread widely in order to carry out preservation playback of music, an image, data, the program, etc. The specification about record and the regenerative signal of this CD is specified as CD specification, and the regenerative apparatus based on this specification has spread widely as a CD player.

[0003] as a postscript mold optical recording medium corresponding to CD specification, CD-Recordable (it abbreviates to CD-R below) is proposed and developed -- [-- for example, Nikkei electronics [ ] -- No.465 and p. --], such as 107, a 1989 year 1 month 23 day number, OPTICAL DATA STORAGE DIGEST SERIES vol.1, p.45, 1989, JP,2-132656,A, JP,2-168446,A, and JP,3-215466,A. The laminating of a record layer, a reflecting layer, and the protective layer is carried out in this order on the transparence resin substrate, and this CD-R records information for a change physical [a record layer] or chemical in the form of a lifting and a pit by irradiating a high-power laser beam at this record layer. The laser beam of low power is irradiated to the formed pit part, and the information on a pit can be reproduced by detecting change of a reflection factor. Commercial CD-R has a record layer containing coloring matter, roughly divides it as this coloring matter, and has phthalocyanine dye and cyanine dye. This reflecting layer is stuck and prepared in the pigment layer, in order to usually obtain the reflection factor based on CD specification, the reflection factor of a reflecting layer is high, and moreover, Au thin film with good corrosion resistance is used [for example, JP,2-79235,A].

[0004] Since these CD-R media perform record and playback using 830-770nm near-infrared semiconductor laser and are based on the specification of CDs, such as Red Book and an Orange Book, they have the description of having a CD player, a CD-ROM player, and compatibility. Recently, red semiconductor laser with a wavelength of 690nm - 620nm was developed, and it became record of high density, and/or reproducible. For example, the high density record medium which has one 5 to 8 times [over the past] the storage capacity of this, and this player corresponding to a high density record medium were developed. Moreover, laser of the wavelength 530nm by higher-harmonic conversion of an YAG laser and near 420nm is put in practical use, and development of the semiconductor laser of the wavelength 490nm, 410nm, and near 370nm is also performed further.

[0005] Then, the optical recording medium which can be written in is proposed once by the high

density using the coloring matter corresponding to such short wavelength laser, and it is necessary in such an optical recording medium to use the reflective film which has a high reflection factor in a short wavelength field. Furthermore, it is necessary to control the thermal conductivity of this reflective film and to optimize the sensibility to decomposition of a record layer, and a laser beam etc. Although alloys, such as Ag-In, Ag-V, or Ag-Nb, were used for the reflective film and thermal conductivity is specified on it by JP,6-243509,A, it is not a thing in consideration of decomposition of a coloring matter record layer. Moreover, when reflective film, such as Au, aluminum, Ag, etc. which are used from the former, was used for the postscript mold optical recording medium which contained coloring matter in the record layer and record playback was carried out using short wavelength laser, problems, such as heat control and adhesion, arose and the reflection factor especially fell extremely on blue laser wavelength by Au.

EFFECT OF THE INVENTION

[Effect of the Invention] Using the suitable element, the reflective film of this invention which has the moderate thermal conductivity which limited that configuration rate had the high reflection factor in the 830-370nm wavelength field, adhesion with a pigment layer is good and a recording characteristic and endurance became possible [offering a good optical recording medium] by using this reflective film.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The purpose of this invention is being a high reflection factor and offering the light reflex film which adhesion with a pigment layer is good and has moderate thermal conductivity in record to the light from near-infrared [which can be used for the optical recording medium which carried out densification by short wavelength-ization of a laser light source, especially the postscript mold high density optical recording medium which contains coloring matter in a record layer] to blue wavelength.

MEANS

[Means for Solving the Problem] this invention persons came to complete this invention, as a result of repeating examination wholeheartedly that the above-mentioned technical problem should be solved. That is, this invention relates to the optical recording medium given [aforementioned] in ** characterized by the reflection factor to an optical recording medium and the laser beam chosen from 450-370nm which carried out incidence from ** substrate side characterized by providing the following being 15% or more. ** It comes to contain one or more sorts each of elements chosen from the 1st group who consists of aluminum and Ag, and the 2nd group who consists of Bi, Rh, and Zn. The light reflex film characterized by a reflection factor being 70% or more to the wavelength light which thermal conductivity is 140-370W/(m-K), and is 830-370nm, ** Use the 1st group's metal as a principal component, and receive the atomic number of all the 1st and 2nd groups' metals. As the light reflex film given [aforementioned] in ** characterized by containing it 1 to 49%, using the 2nd group's metal as an atomic number, and **aluminum, Bi and/or Rh, or the aforementioned ** characterized by containing Ag, Bi, and/or Zn or the light reflex film given in **, and ** -- the record layer which contains coloring matter

at least on a transparent substrate Reflective film given in either the aforementioned ** - **
[0008]
[Embodiment of the Invention] The reflective film of this invention which combined the specific element at a certain rate has 70% or more of high reflection factor to the light of a near-infrared - blue wavelength field, and moreover has thermal conductivity moderate when adapted for an optical recording medium, and its adhesion with a pigment layer is good. The rate of these elements that the reflective film of this invention comes to contain one or more sorts each of elements chosen from the 1st group who consists of aluminum and Ag, and the 2nd group who consists of Bi, Rh, and Zn, and are occupied to a reflecting layer is 50% of the weight or more of a thing. Especially the reflective film of this invention enables good record and playback in a blue wavelength field in the optical recording medium of the postscript mold which used coloring matter for the record layer from green.
[0009] The laser beam as used in the field of this invention is the laser of the wavelength the blue semiconductor laser of the wavelength the green laser of the oscillation wavelength the near-infrared semiconductor laser of the oscillation wavelength near 830 or 780nm, 680 and 650 and the red semiconductor laser of the oscillation wavelength near 635nm, 530nm, and near 490nm, 410nm, and near 370nm, 530nm by higher-harmonic conversion of an YAG laser, and near 420nm further. The optical recording medium of this invention is refreshable in one wave or two or more wavelength which are chosen from these, and a reflection factor is 15% or more.
[0010] The concrete configuration of this invention is explained below at a detail. The reflective film of this invention contains one or more sorts each of elements chosen from the 1st group who consists of aluminum and Ag, and the 2nd group who consists of Bi, Rh, and Zn. The thermal conductivity of this reflective film is 140 - 370W/(m-K), and a reflection factor is 70% or more in 830-370nm wavelength light. In addition, it takes into consideration and it is determined that it is desirable that the sum total of the content atomic number the 2nd group's metal is 1 - 49% to the sum total atomic number of all the metals of the 1st and the 2nd group, and the value of this mixed rate of thermal conductivity suits to a predetermined value. It is the reflective film which comes to contain aluminum, Bi and/or Rh or Ag and Bi, and/or Zn preferably especially.
[0011] The thermal conductivity of the reflective film of this invention is 140 - 370W/(m-K). When for the optical recording medium which used coloring matter as the record layer, and heat is [such reflective film] bank-easy in a record layer and thermal conductivity records it on it by the reflective film of 140W / (m-K) following, a beautiful pit is hard to be obtained for the effect of the heat around a record pit. On the other hand, by the larger reflective film than 370W/(m-K), there is an inclination for record sensibility to fall that the heat of a record layer tends to escape. Furthermore, if it is the reflective film of this invention, the adhesion between a record layer and a reflecting layer will make it good, and the endurance of a medium will improve.
[0012] Moreover, although the reflective film of this invention mainly contains the metal of the aforementioned 1st and the 2nd aforementioned group, other metals may be contained and Cu, V, Ta, Cr, Mo, W, Mn, Fe, Co, nickel, Pd, Pt, Au, etc. are mentioned as other metals. In the reflective film of this invention, the total content (sum total of a content atomic number) of one or more metals chosen from a metal besides these is 20% or less to all the atomic numbers of aluminum and/or Ag. As the formation approach of the reflective film of this invention, a spatter, the ion plating method, chemical vapor deposition, a vacuum deposition method, etc. are mentioned, and membranes are usually formed to the thickness which is 500-2000A, for example. The spatter which used the plural metal target or the alloy target especially is desirable.
[0013] Next, it describes about the optical recording medium using the reflective film of this

invention as a reflecting layer. The optical recording medium as used in the field of this invention shows both the medium for photoregeneration only for playbacks which is having information recorded beforehand, and the optical recording medium which can record information and can be reproduced. Here, the optical recording medium which formed the record layer, the reflecting layer, and the protective layer in this order on the optical recording medium whose playback records the information on latter and is possible as a good example, especially the substrate, and the optical recording medium which stuck the substrate on the reflecting layer side are explained. In addition, another layer may intervene between a reflecting layer and a substrate etc. between a reflecting layer and a protective layer between a record layer and a reflecting layer between a substrate and a record layer.

[0014] As the quality of the material of a substrate, fundamentally, if transparent on the wavelength of record light and playback light, it is good. For example, polymeric materials, such as acrylic resin, such as polycarbonate resin, vinyl chloride resin, and a polymethyl methacrylate, polystyrene resin, and an epoxy resin, and inorganic materials, such as glass, are used. These substrate ingredients are fabricated by the substrate disc-like by an injection-molding method etc. In the case of a postscript mold optical recording medium, a slot may be formed in a substrate front face if needed.

[0015] As a record layer, it has moderate absorption in a laser wavelength region, and it is a layer containing matter which is the exposure with the energy more than fixed of a laser beam, and is accompanied by physical/chemical deformation, deterioration, and decomposition, and this invention mainly contains coloring matter. for example, as an ingredient which has effective record ability in case record playback wavelength is 450nm - 370nm lambdamax It exists near 350nm, the refractive index in 450-370nm is large, and what has a small absorbance is desirable. Specifically Spiro system coloring matter, stilbene system coloring matter, full olein system coloring matter, imidazole system coloring matter, There are perylene system coloring matter, phenazine system coloring matter, phenothiazin system coloring matter, polyene system coloring matter, quinone system coloring matter, cyanine system coloring matter, an acridine dye, AKURIJINON system coloring matter, coumarin system coloring matter, KARUBO styryl system coloring matter, porphin system coloring matter, squarylium system coloring matter, etc. Preferably, they are polyene system coloring matter, stilbene system coloring matter, and quinone system coloring matter. in addition, the coloring matter which a record layer is made to contain in this invention -- said coloring matter -- independent -- you may use -- two or more sorts of coloring matter -- mixing -- or a laminating may be carried out.

[0016] Moreover, it is also possible to introduce as a substituent the radical which shows mixing or such engine performance to coloring matter if needed for additives, such as a quencher, a coloring matter pyrolysis accelerator, an ultraviolet ray absorbent, and adhesives. As a quencher, metal complexes, such as bis-dithiol systems, such as an acetylacetonato system, a bis-dithio-alpha-diketone system, and a bis-phenyl dithiol system, a thio catechol system, a salichlaldehyde oxime system, and a thio bis-phenolate system, are desirable. Moreover, an amine system is also suitable.

[0017] As a coloring matter pyrolysis accelerator, especially if promotion of the pyrolysis of coloring matter can be checked, it will not be limited by heat loss-in-quantity analysis (TG analysis) etc., for example, metallic compounds, such as a metal system anti knocking agent, a metallocene compound, and an acetylacetonate system metal complex, are mentioned. As an example of a metal system anti knocking agent, the tetracethyl lead, other lead system compounds, As an example of Mn system compound of SHIMANTOREN [Mn (CO)3 (C five

H5)] etc., and a metallocene compound There are bis(cyclopentadienyl) metal complexes including an iron bis(cyclopentadienyl) complex (ferrocene), such as Ti, V, Mn, Cr, Co, nickel, Mo, Ru, Rh, Zr, Lu, Ta, W, Os, Ir, Sc, and Y. A ferrocene, RUTENOSEN, male MOSEN, nickelocene, titanocene, and those derivatives have a good pyrolysis facilitatory effect especially.
[0018] As iron system metallic compounds, besides a metallocene In addition, formic-acid iron, a ferrous oxalate, Organic-acid iron compounds, such as lauryl iron oxide, naphthenic-acid iron, stearin acid iron, and butanoic acid iron, An acetylacetonato iron complex, a phenanthroline iron complex, a bis-pyridine iron complex, An ethylenediamine iron complex, an ethylenediaminetetraacetic acid iron complex, a diethylenetriamine iron complex, A diethylene-glycol wood ether iron complex, a JIHOSUFINO iron complex, Chelate iron complexes, such as a dimethyl GURIOKISHI mart iron complex, a carbonyl iron complex, iron complexes, such as a cyano iron complex and an ammine iron complex, ferrous chloride, a ferric chloride, the ferrous bromide, and bromination -- inorganic iron salt, such as halogenation iron, such as the second iron, or iron nitrate, and an iron sulfate, -- an iron oxide etc. is mentioned further. The good thing of resistance to moist heat and lightfastness meltable to an organic solvent and of the pyrolysis accelerator used here is desirable. Varieties may be mixed and used for various kinds of quenchers and coloring matter pyrolysis accelerators which were mentioned above if needed, or they may add quality of an additive, such as a binder, a leveling agent, and a defoaming agent.
[0019] As the production approach of a record layer, there are the applying methods, such as a spin coat method and the cast method, a spatter, an optical CVD method, the ion plating method, electron beam vacuum deposition, chemical vapor deposition, a vacuum deposition method, etc., and especially limitation is not carried out. However, production according to the applying method at the point which the degree of freedom and ease on coloring matter selection, a medium design, and manufacture expand more in this invention is desirable. The solvent used by the applying method dissolves or is not easy to distribute coloring matter, and must not give a damage to a substrate. for example, alcoholic system solvents (a methanol, ethanol, propanol, etc.) a halogenation alcoholic system solvent (2, 2, 3, and 3-tetrafluoro-1-propanol --) hexafluoro isopropanol etc. and a hydrocarbon system solvent (a hexane --) A cyclohexane, ethylcyclohexane, cyclooctane, dimethylcyclohexane, an octane, benzene, toluene, a xylene, etc. and a halogenated hydrocarbon system solvent (dichloromethane --) Chloroform, a hydrocarbon tetrachloride, tetrachloroethylene, dichloro difluoroethane, etc., an ether system solvent (a tetrahydrofuran, diethylether, and the dipropyl ether --) dibutyl ether, dioxane, etc. cellosolve system solvents (methyl Cellosolve, ethyl Cellosolve, etc.), and ketone system solvents (an acetone, a cyclohexanone, methyl ethyl ketone, etc.) Ester system solvents (ethyl acetate, butyl acetate, etc.) etc. -- it is mentioned. these solvents -- one sort -- or more than one are mixed and it is used.
[0020] As an applying method, the approach of dissolving in a solvent and applying by the spin coater is desirable so that it may become about binder resin and may become 0.5 - 20 % of the weight preferably 0.05 to 30% of the weight about coloring matter 0% 20 or less % of the weight. Although the thickness of a record layer is 30-1000nm, it is usually 50-500nm preferably. In addition, although it is natural, if this thickness is not much thin, for example, is less than 30nm thickness, the heat dissipation to a metallic reflective layer cannot be avoided, but a sensibility fall may be caused. Thickness is set up so that the absorbance to the light of the playback laser wavelength of a record layer may become suitable.
[0021] Although a reflecting layer is the approach which was described above and forms membranes on a record layer, in order to raise a reflection factor and to improve adhesion, it can

also prepare a reflective magnification layer and a glue line between a record layer and a reflecting layer. A protective layer can also be made to form by the still better known approach on a reflecting layer. As an ingredient of a protective layer, if a reflecting layer is protected from external force, any of organic and mineral matter will be sufficient and it will not be limited especially. As an organic substance, thermoplastics, thermosetting resin, UV hardenability resin, etc. can be mentioned, and UV hardenability resin is desirable especially. As mineral matter, SiO2, SiO, SnO2, Si3 N4, MgF2, AlN, etc. are mentioned.

[0022] When using thermoplastics, thermosetting resin, etc., it can dissolve in a suitable solvent and a protective layer can be formed by applying coating liquid on a reflecting layer and drying. After dissolving in a solvent remaining as it is or suitable and preparing coating liquid, in the case of UV hardenability resin, this coating liquid can be applied, and it can form a protective layer by irradiating UV light and stiffening it. As UV hardenability resin, acrylate resin, such as urethane acrylate, epoxy acrylate, and polyester acrylate, can be used, for example. These ingredients are independent, or may be mixed and used, and even if it uses by making it not only one layer but multilayers, it does not interfere at all.

[0023] Although the applying methods, such as a spin coat method and the cast method, a spatter, chemical vapor deposition, etc. are used like a record layer as the approach of formation of a protective layer, a spin coat method is desirable also in this. Although the thickness of a protective layer is generally in the range of 0.1-100 micrometers, in this invention, its 3-30-micrometer thickness is desirable.

[0024] Moreover, or the optical recording medium of this invention sticks a protection sheet or a substrate on a reflecting layer side, it may be the lamination of ** making both reflecting layer sides counter as the inside, and sticking two optical recording media. The optical recording medium of this invention can also perform printing of a label etc. further on a protective layer.

EXAMPLE

[Example] Although the example of this invention is shown below, thereby, this invention is not limited at all.

[Example 1] The disc-like thing with an outer diameter [of 120mm] and a thickness of 0.6mm which has the continuous guide rail (track pitch: 0.7 micrometers) by the product made of polycarbonate resin as a substrate was used. It is 2, 2, 3, and 3-tetrafluoro in 0.25g of polyene compounds expressed with the following type (** 1) on this substrate. - 1 - The spin coat of the coloring matter solution which dissolved in propanol 10ml was carried out by rotational frequency 2000rpm, it was dried at 70 degrees C for 2 hours, and the optical recording layer with a thickness of about 100nm was formed.

[0026]

[Formula 1]

[0027] On this record layer, the Shimadzu sputtering system was used, DC spatter of 2 yuan using aluminum target and Bi target was performed, and the aluminum-Bi reflective film with a thickness of 100nm was formed. It carried out to sputtering gas on condition that spatter power 0.5A and sputtering gas ** 1.0x10-3Torr using argon gas. The several % atom of Bi/(aluminum+Bi) was about 8% as a result of the surface analysis of the formed reflective film. To coincidence, the aluminum-Bi alloy film with a thickness of 100nm was prepared on the glass

plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was with 73% or more, and thermal conductivity was 190W/(m-K). Furthermore, on the reflecting layer, after carrying out the spin coat of the ultraviolet-rays hardening resin, UV irradiation of said substrate and the substrate without the same guide rail was carried and carried out, the substrate was stuck, and the optical recording medium was produced.

[0028] The eight-to-fourteen modulation signal whose shortest pit is 0.4 micrometers was recorded on this medium by linear-velocity 5.6 m/s and laser power 10mW using the Pulstec Industrial optical disk evaluation equipment (DDU-1000) and the EFM encoder made from KENWOOD which carried the 430nm blue higher-harmonic-wave conversion laser head (NA=0.65). As a result of setting a laser output to 0.5mW using this evaluation equipment, reproducing a signal after record and measuring a reflection factor, an error rate, and a jitter, all showed the good value. In addition, IKORAIZESHON processing was performed at the time of playback. As a result of performing an acceleration deterioration test (it is 100 hours at 85% of humidity RH, and 80 degrees C) and measuring the reflection factor and error rate after a trial about this recorded medium, it was checked that change has the small excellent endurance.

[0029] [Example 2] DC spatter of 2 yuan using aluminum target and Rh target was performed, and the optical recording medium was produced like the example 1 except forming the aluminum-Rh reflective film with a thickness of 100nm. The several % atom of Rh/(aluminum+Rh) was about 20% as a result of the surface analysis of the formed reflective film. To coincidence, the aluminum-Rh alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was with 75% or more, and thermal conductivity was 200W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. After record, as a result of performing the same measurement as an example 1, a good recording characteristic and endurance were shown.

[0030] [Example 3] DC spatter of 3 yuan using aluminum, Rh, and Bi target was performed, and the optical recording medium was produced like the example 1 except forming the aluminum-Rh reflective film with a thickness of 100nm. The several % atom of (Rh+Bi)/(aluminum+Rh+Bi) of the atomic ratio of Bi/Rh was about 1/7 about 40% as a result of the surface analysis of the formed reflective film. To coincidence, the aluminum-Rh-Bi alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was with 72% or more, and thermal conductivity was 160W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. After record, as a result of performing the same measurement as an example 1, a good recording characteristic and endurance were shown.

[0031] [Example 4] DC spatter using the alloy target (atomic ratio Ag:Bi=85:15) of Ag and Bi was performed, and the optical recording medium was produced like the example 1 except forming the Ag-Bi reflective film with a thickness of 100nm. The several % atom of Bi/(Ag+Bi) was about 15% as a result of the surface analysis of the formed reflective film. To coincidence, the Ag-Bi alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm

- 370nm wavelength field, the reflection factor was with 75% or more, and thermal conductivity was 270W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. After record, as a result of performing the same measurement as an example 1, a good recording characteristic and endurance were shown.

[0032] [Example 5] DC spatter using the alloy target (atomic ratio Ag:Zn=60:40) of Ag and Zn was performed, and the optical recording medium was produced like the example 1 except forming the Ag-Zn reflective film with a thickness of 100nm. The several % atom of Zn/(Ag+Zn) was about 39% as a result of the surface analysis of the formed reflective film. To coincidence, the Ag-Zn alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was with 72% or more, and thermal conductivity was 290W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. After record, as a result of performing the same measurement as an example 1, a good recording characteristic and endurance were shown.

[0033] [Example 6] DC spatter using the alloy target (atomic ratio Ag:Zn=80:20) of Ag and Zn was performed, and the optical recording medium was produced like the example 1 except forming the Ag-Zn reflective film with a thickness of 100nm. The several % atom of Zn/(Ag+Zn) was about 19% as a result of the surface analysis of the formed reflective film. To coincidence, the Ag-Zn alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was with 75% or more, and thermal conductivity was 340W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. After record, as a result of performing the same measurement as an example 1, a good recording characteristic and endurance were shown.

[0034] [Example 7] DC spatter using the alloy target (atomic ratio Ag:Bi:Zn=65:5:30) of Ag, Bi, and Zn was performed, and the optical recording medium was produced like the example 1 except forming the Ag-Bi-Zn reflective film with a thickness of 100nm. The several % atom of (Bi+Zn)/(Ag+Bi+Zn) of the atomic ratio of Bi/Zn was about 1/6 about 34% as a result of the surface analysis of the formed reflective film. To coincidence, the Ag-Bi-Zn alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was with 72% or more, and thermal conductivity was 310W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. After record, as a result of performing the same measurement as an example 1, a good recording characteristic and endurance were shown.

[0035] [Example 1 of a comparison] In the example 1, the Shimadzu sputtering system was used on the record layer, DC spatter of the aluminum was carried out, and the optical recording medium was similarly produced except having formed the reflecting layer with a thickness of 100nm. To coincidence, aluminum alloy film with a thickness of 100nm was prepared on the

glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was 80% or more, and thermal conductivity was 220W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. After record, as a result of performing the same measurement as an example 1, although the good recording characteristic was shown, endurance was bad.

[0036] [Example 2 of a comparison] In the example 1, the Shimadzu sputtering system was used on the record layer, DC spatter of Ag was carried out, and the optical recording medium was similarly produced except having formed the reflecting layer with a thickness of 100nm. To coincidence, Ag alloy film with a thickness of 100nm was prepared on the glass plate of 5cm angle, and a spectral reflectance and thermal conductivity were measured. Consequently, in the 830nm - 370nm wavelength field, the reflection factor was 80% or more, and thermal conductivity was 408W/(m-K). the Pulstec Industrial make which carried the 430nm blue laser head in the produced medium like the example 1 -- it recorded using optical disk evaluation equipment DDU-1000 and the EFM encoder made from KENWOOD. after record, as a result of performing the same measurement as an example 1, bad good recording characteristic profit **** and endurance also had bad record sensibility.

[0037] In addition, the reflection factor before and behind the acceleration deterioration test carried out about the recorded medium which was obtained in examples 1-7 and the examples 1 and 2 of a comparison (after the first stage and a trial), the error rate, and the value of a jitter were collectively indicated to (Table 1).

[0038]

[Table 1]